Alipour, M. M.; **Shariyat, M.**

An elasticity-equilibrium-based zigzag theory for axisymmetric bending and stress analysis of the functionally graded circular sandwich plates, using a Maclaurin-type series solution.

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Summary: The available semi-analytical solutions for bending and stress analysis of the composite/sandwich plates have mainly been proposed for rectangular plates with specific material properties and edge conditions. In the present paper, axisymmetric bending and stress analysis of circular functionally graded sandwich plates subjected to transversely distributed loads is performed. The governing equations are derived based on an elasticity-equilibrium-based (rather than the traditional constitutive-equations-based) zigzag theory. Therefore, both ideas of using the local variations of the displacement field and satisfying a priori the continuity conditions of the transverse stresses at the layer interfaces for predicting the global and local responses of the sandwich circular plates are employed, for the first time. The resulting governing equations are then solved by a semi-analytical Maclaurin-type power-series solution. Each layer of the plate may be made of functionally graded materials. The transverse shear and normal stresses are determined based on the three-dimensional theory of elasticity. Comparisons made with results of a numerical finite element code (ABAQUS software) reveal that even for thick sandwich plates with soft cores, accuracy of results of the present formulation is comparable with that of the three-dimensional theory of elasticity.

MSC:

74K20 Plates
74G60 Bifurcation and buckling
74E30 Composite and mixture properties

Keywords:

bending stress; zigzag theory; functionally graded circular sandwich plate; semi-analytical

Software:

ABAQUS

Full Text: DOI

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